FINAL REMEDIAL INVESTIGATION/ FEASIBILITY STUDY FOR MUSCOY PLUME OPERABLE UNIT NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE

Prepared for:

Contract No. 68-W9-0054 / WA No. 54-38-9NJ5
U.S. Environmental Protection Agency
Region IX
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San Francisco, California 94105

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December 2, 1994

Mr. Kevin Mayer (H-6-4)
U.S. Environmental Protection Agency
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Subject: **Contract No. 68-W9-0054 / WA No. 54-38-9NJ5**
Muscoy Plume OU RI/FS - Newmark Groundwater Contamination Superfund Site
Transmittal of Final RI/FS Report

Dear Mr. Mayer:

Enclosed are five (5) complete copies and four (4) copies without appendices of the Final RI/FS Report for the Muscoy Plume OU. One of the enclosed complete copies is unbound and not hole-punched, per your request. Please refer to the distribution list in the final report for a list of the recipients. All copies contain your cover letters, dated December 2, 1994, listing the Federal Express tracking number, when applicable.

Thank you for the opportunity to provide EPA with remedial efforts on the Muscoy Plume OU. If you have any questions, please call me at (916) 929-2346.

Sincerely,

URS CONSULTANTS, INC.

Kent E. Parrish, CA R.G. 5188
Site Manager

Enclosure

cc: Jeri Simmons, EPA Region IX (P-7-2), w/o encl.
Travis Cain, EPA Region IX (H-8-2), w/o encl.
Project and Chron Files

(62380-C/mp-rifs.r-0)

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ABBREVIATIONS AND ACRONYMS

(ft/day)/ft	Feet per day per foot
AALs	Applied Action Levels
AOP	Advanced oxidation process
ARARs	Applicable or relevant and appropriate requirements
atm	Atmospheric pressure
BACT	Best available control technology
bgs	Below ground surface
BNA	Base neutral acids
CARB	California Air Resources Board
CCR	California Code of Regulations
CDI	Chronic daily intakes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLP	Contract Laboratory Program
COCs	Contaminants of concern
COPCs	Chemicals of potential concern
CPFs	Cancer potency factors
CSFs	Chemical-specific cancer potency factors
DCA	1,1-dichloroethane
DCE	Cis-1,2-dichloroethene
DHS-ODW	Department of Health Servies - Office of Drinking Water
DHS-PWSB	Department of Health Services - Public Water Supply Branch
DHS-TSCD	Department of Health Services - Toxic Substances Control Division
DNAPL	Dense nonaqueous phase liquid
DQOs	Data quality objectives
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
E&E	Ecology and Environment, Inc.
EMSL	Environmental Monitoring Systems Laboratory
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Association
ft/ft	Feet per foot
ft/yr	Feet per year
ft^3/day	Cubic feet per day
g/cm^3	Grams per cubic centimeter
g/m^3	Gram per cubic meters
g/mole	Gram per molecular weight
g/mℓ	Grams per milliliter
GAC	Granular activated carbon
gpd/ft	Gallons per day per foot
gpm	Gallons per minute
H&S	Health and safety
HEAST	Health Effects Assessment Summary
HI	Hazard index

ABBREVIATIONS AND ACRONYMS (Cont'd.)

HQ	Hazard quotient
IRIS	Integrated Risk Information System
ISR	Interim sampling report
LDRs	Land disposal restrictions
m^3/mole	Cubic meters per molecular weight
MCLGs	Maximum contaminant level goals
MCLs	Maximum contaminant levels
MDL	Method detection limit
mg/ℓ	Milligram per liter
mgd	Million gallons per day
mm	Millimeter
mmHg	Millimeters of mercury
MMO	Methane mono-oxygenase
msl	Mean sea level
NAPL	Nonaqueous phase liquid
NCP	National Oil and Hazardous Substances Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTUs	Nephelometric turbidity limits
O&M	Operation and maintenance
OHM/M	Ohms per meter
OU	Operable unit
PCBs	Polychlorinated biphenyls
PCE	Tetrachloroethene (formerly Perchloroethylene)
PM	Particulate matter
POTW	Publicly owned treatment works
PP	Proposed plan
ppb	Parts per billion
ppbv	Parts per billion by volume
PRPs	Potentially responsible parties
psi	Pounds per square inch
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
RA	Remedial action
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RD	Remedial design
RfDs	Reference doses
RI/FS	Remedial investigation/feasibility study
RME	Reasonable maximum exposure
ROD	Record of decision
RWQCB	Regional Water Quality Control Board
SALs	State Action Levels
SARA	Superfund Amendment and Reauthorization Act of 1986
SARWQCB	Santa Ana Regional Water Quality Control Board

ABBREVIATIONS AND ACRONYMS (Cont'd.)

SAS	Special Analytical Services
SBVMWD	San Bernardino Valley Municipal Water District
SCAQMD	South Coast Air Quality Management District
SDWS	California's Secondary Drinking Water Standards
SITE	Superfund innovative technology evaluation
SMCLs	State maximum contaminant levels
SOW	Statement of work
SP	Specific potential
SVE	Soil vapor extraction
T(°K)	Temperature in degrees kelvin
TBCs	Other criteria or guidelines to be considered
TCE	Trichloroethene
TEAM	Total exposure assessment methodology
TPH	Total petroleum hydrocarbons
TTLC	Total threshold limit concentration
UCL	Upper confidence level
URS	URS Consultants, Inc.
UV	Ultraviolet
VOAs	Volatile organic analytes
VOCs	Volatile organic compounds
WA	Work assignment
$\mu g/\ell$	Microgram per liter

EXECUTIVE SUMMARY

INTRODUCTION

In 1980, the California State Department of Health Services detected concentrations of trichloroethene (TCE) and tetrachloroethene [formerly termed perchloroethylene (PCE)]) in municipal water supply wells (municipal supply wells) in the northern San Bernardino/Muscoy region which exceeded California's public health action levels for drinking water. Subsequently, a number of investigations were conducted to determine the source(s) of the contamination. On March 31, 1989, the U.S. Environmental Protection Agency (EPA) listed the Newmark Groundwater Contamination Superfund Site on the National Priorities List (NPL).

In 1990, the EPA began the remedial investigation/feasibility study (RI/FS) process on the Newmark Operable Unit (OU). Based on the findings of the Newmark OU RI/FS, two new OUs (Newmark and Muscoy) were formed in September 1993 to better focus the search for potential contaminant source(s). The Muscoy OU was further divided (January 1994) into two OUs: the Source and the Muscoy Plume.

This RI/FS Report focuses on the Muscoy Plume OU. The RI/FS was conducted to address the EPA's site-specific objectives and to collect data necessary to develop and evaluate remedial alternatives for the Muscoy Plume OU.

The RI/FS was completed in three phases, with each phase providing information to guide the subsequent phase. The three phases were:

- Scoping Phase - During this initial phase, data were collected to support the RI/FS, and the project groundwater flow model that was developed during the Newmark OU RI/FS was modified with additional information and recalibrated to focus on the Muscoy Plume OU;
- Remedial Investigation Phase - The RI phase involved a field investigation to collect data to characterize the groundwater contamination and develop remedial alternatives; and
- Feasibility Study Phase - The FS phase included the development and screening of remedial alternatives and preparation of a detailed analysis in support of remedial action.

SCOPING PHASE

As part of the scoping phase, previous reports and other information were reviewed to provide focus for the activities of the RI and FS phases; specifically, information from the Newmark OU RI/FS was used extensively due to the similarities in project scope and environmental setting of the two OUs.

Laboratory analysis of groundwater samples collected from monitoring and municipal supply wells during the scoping phase of the project consistently identified a number of organic contaminants. These contaminants included 1,1-dichloroethane (DCA), cis-1,2-dichloroethene (DCE), trichlorofluoromethane (freon 11), dichlorodifluoromethane (freon 12), TCE, and PCE. TCE and PCE were the only contaminants detected within the aquifer at concentrations exceeding federal maximum contaminant levels (MCLs) for drinking water. Cis-1,2 dichloroethene, however, was detected in one well (MUNI-109) at the State of California MCL of 6 $\mu g/\ell$. Interim remedial measures have since been implemented at municipal supply wells affected by the TCE and PCE contamination. These measures included deactivating the wells or treating the pumped groundwater prior to usage.

REMEDIAL INVESTIGATION PHASE

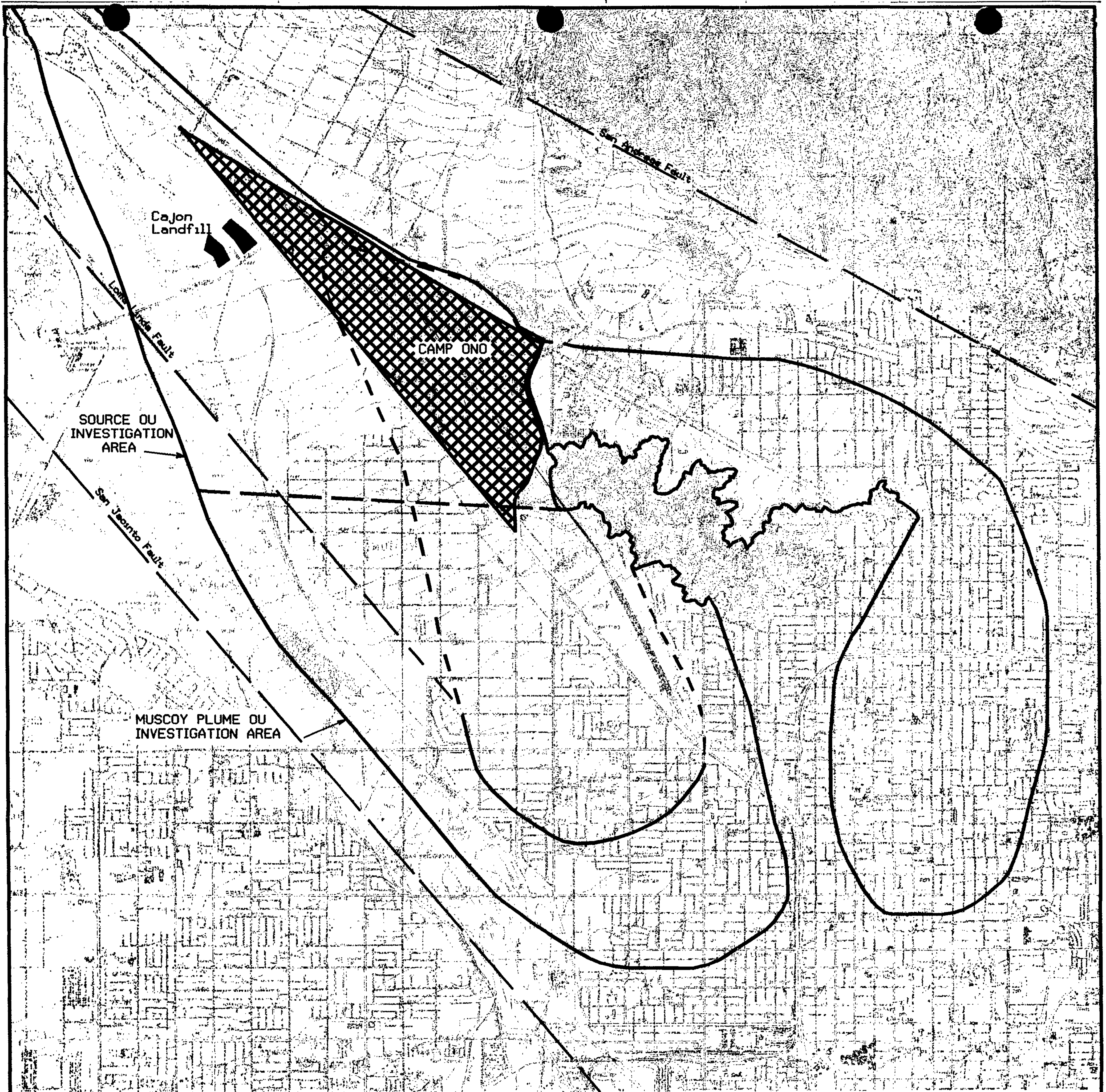
During the RI phase, existing municipal supply wells were sampled in the Muscoy Plume OU (April through May 1993) in order to confirm the presence of groundwater contamination. Chemical testing of groundwater included a broad suite of chemicals. Groundwater analytical data from municipal supply wells provided data on downgradient contaminant migration.

Although groundwater contamination is present approximately four miles upgradient of the Muscoy Plume OU near the Cajon Landfill, there is no confirmed connection between these two areas. The search for source areas of contamination for both the Muscoy Plume and the Newmark OUs is being conducted as part of the Source OU RI/FS.

Based on the integration of all available data, a contamination map was developed for the entire Newmark Groundwater Contamination Superfund Site (Figure ES-1). The existing contamination in the Muscoy Plume OU is approximately two miles long and one and one-half miles wide at its widest point. The greatest concentration of contaminants appears to be located in well MUNI-106 in the eastern portion of the Muscoy Plume OU. The vertical distribution of contamination in this OU is not well defined but is considered sufficient to make a determination on a remedial alternative.

Since the mid-1980s, a general decrease in concentrations of both TCE and PCE has been observed in the upgradient portion of the Newmark OU (Newmark Wellfield) while a general increase has been noted in the downgradient portion of that OU. Time series chemical data for the Muscoy Plume OU were not available but will be evaluated during the Source OU RI/FS. From what data were available, a project groundwater flow model was developed to estimate groundwater flow and contaminant movement, and to screen the remedial alternatives for the Muscoy Plume OU. MODFLOW, a computer program developed by the U.S. Geological Survey, was used as the source code for the project flow model.

The project flow model was used to estimate the average groundwater velocity for the Muscoy Plume OU. The average groundwater velocity was calculated at slightly over one foot per day (500 ft/yr). Due to the chemical and physical interactions between the aquifer and the contaminants (a process called retardation), TCE and PCE migration rates may be different than the average groundwater velocity.



LEGEND

Approximate Extent Groundwater Contamination, K. Mayer EPA

Investigation Area

Camp Ono

Fault

0 ½ 1
SCALE IN MILES

N

Base Map: USGS San Bernardino Quad

URS Consultants, Inc. Sacramento, Ca	MUSCOY PLUME OU RI/FS REPORT NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE	FIGURE ES-1 PLUME LOCATIONS

FEASIBILITY STUDY PHASE

The feasibility study considered site-specific remedial action objectives regarding human health and environmental protection. These objectives, based on MCLs, are divided into RI/FS objectives and overall project (RI/FS and RD/RA) objectives:

RI/FS Objective:

- Provide data for the Record of Decision (ROD) to support selection of the remedial design (RD) and construction of the selected remedy.

Overall Project Objectives:

- Control contaminant plume migration;

- Protect downgradient municipal supply wells southwest of Shandin Hills in San Bernardino, California; and

- Facilitate the long-term cleanup objective of restoration of the aquifer to beneficial uses by removing groundwater contaminants. The Interim Action associated with the Muscoy Plume OU does not directly address the long-term cleanup objective but must be consistent with it.

After a series of initial screening steps, viable remedial alternatives were subjected to a detailed analysis. The detailed analysis focused on the performance of each remedial alternative with respect to EPA's evaluation criteria and the ability of each alternative to meet these objectives. The remedy for the Muscoy Plume OU will be an Interim Remedy with limited but time-critical objectives. Therefore, none of the following alternatives were considered permanent. Because the alternatives do not provide permanent remedies, they are subject to the Superfund Amendment and Reauthorization Act of 1986 (SARA) which, in part, requires that contamination threats be reviewed every five years.

- Alternative 1: No Action. This alternative consists of quarterly sampling and water level monitoring from three existing monitoring wells (Cajon Landfill), four new (to be installed) monitoring wells, and fifteen existing municipal supply wells.

- Alternative 2: Aqueous-Phase Granular Activated Carbon (GAC) with Municipal End Use. This alternative would use three 1,500 gpm and one 1,700 gpm groundwater extraction wells, placed ahead of the leading edge of the plume. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to a treatment plant for GAC treatment. The treated groundwater would be subsequently delivered into the municipal water supply system.

- Alternative 3: Air Stripping with Best Available Control Technology (BACT) Off-Gas Treatment with Municipal End Use. This alternative would use three (3), 1,500 gpm and one (1), 1,700 gpm groundwater extraction wells, placed at the leading edge of the plume. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to a Treatment Plant for air stripping treatment. The treated groundwater would be subsequently delivered into the municipal water supply system.

- Alternative 4: Advanced Oxidation (Ozone/Peroxide) Treatment with Municipal End Use. This alternative would use three 1,500 gpm and one 1,700 gpm groundwater extraction wells, placed at the leading edge of the plume. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to a Treatment Plant for advanced oxidation treatment. The treated groundwater would be subsequently delivered into the municipal water supply system.

- Alternative 5: Aqueous-Phase GAC Treatment with Reinjection. This alternative would use three 1,500 gpm and one 1,700 gpm groundwater extraction wells, placed at the leading edge of the plume. Extracted groundwater from the leading edge of the plume would be delivered through underground piping to a Treatment Plant for GAC treatment. The treated water would subsequently be reinjected into the groundwater aquifer through eight injection wells placed along the western and eastern edges of the plume. The locations of the injection wells would be designed to help focus groundwater extraction.

Following the detailed analysis, the alternatives were compared to each other. The comparative analysis, as presented in Table ES-1, quantifies the relative advantages and disadvantages of the alternatives. The EPA will use this information to develop the Proposed Plan (PP) which will identify a preferred alternative. After a public comment period, EPA will select one of the alternatives or a combination of them to begin cleanup of groundwater contamination. EPA will summarize the alternative selected in the ROD for the Muscoy Plume OU several months after the close of the comment period.

Table ES-1
Alternative Comparative Analysis
Muscoy Plume Operable Unit RI/FS Report

Remedial Alternative	Overall Protection of Human Health and the Environment[a]	Compliance with ARARs[a]	Long-term Effectiveness and Permanence[b]	Reduction of Toxicity, Mobility, or Volume[b]	Short-term Effectiveness[b]	Implementability[b]	Cost[b]	Total Score
Alternative 1: No Action	No	No	1	1	5	5	5	18
Alternative 2: Aqueous-Phase GAC with Municipal End Use	Yes	Yes	4	4	4	4	3	19
Alternative 3: Air Stripping with Vapor-Phase Off-Gas Treatment and Municipal End Use	Yes	Yes	4	3	4	3	4	18
Alternative 4: Advanced Oxidation (Ozone/Peroxide) with Municipal End Use	Yes	Yes	4	5	3	2	1	16
Alternative 5: Aqueous-Phase GAC with Reinjection	Yes	Yes	4	4	4	4	2	18

Notes: a. Yes = Meets the criteria; No = Does not meet the criteria.
b. Evaluated on scale from 1 (minimally) to 5 (maximally) in meeting the criteria.

1.0 INTRODUCTION

In 1980, the California Department of Health Services investigated and discovered solvent contaminants in several municipal water-supply wells (municipal supply wells) within the northern section of the San Bernardino/Muscoy region. Following this discovery, several investigations were conducted to locate the potential source(s) of contamination. On March 31, 1989, the U.S. Environmental Protection Agency (EPA) placed this region on the National Priorities List (NPL); this action released federal funds for cleanup and renamed this region the Newmark Groundwater Contamination Superfund Site (Figure 1-1).

The EPA has been in the process of conducting a remedial investigation/feasibility study (RI/FS) for this Superfund site since 1990. Based on the findings of the Newmark Operable Unit (OU) RI/FS, two OUs (Newmark and Muscoy) were formed in September 1993 to better focus the search for potential contaminant source(s). The Muscoy OU was further subdivided (January 1994) into two OUs: the Source and the Muscoy Plume OUs. Figure 1-1 shows the Newmark and Muscoy plume boundaries that correspond to the Newmark and Muscoy Plume OUs, respectively. The plume boundaries (and OU boundaries) are approximate and are continually refined as new information becomes available.

The Newmark plume is a large chlorinated solvent plume - trichloroethene (TCE) and tetrachloroethene (formerly termed perchloroethene [PCE]) beneath the City of San Bernardino, east of Shandin Hills. The concentrations of contaminants within this five-mile-long plume have caused the closure or addition of wellhead treatment to of a number of municipal supply wells and continue to threaten downgradient wells that supply water for approximately 500,000 people. Trichlorofluoromethane (freon 11) and dichlorodifluoromethane (freon 12) also occur in significant but non-toxic concentrations within the Newmark plume.

The Muscoy plume contains similar contaminants which have impacted approximately two miles of aquifer on the west side of the Shandin Hills. Although this plume initially appeared to have a separate source from the Newmark plume, efforts during the Newmark OU RI/FS traced the Newmark plume upgradient and to the west from the originally suspected source, and showed that its source is probably emanating from an area north and west of Shandin Hills. This information led EPA in September 1992 to officially expand the Newmark site to include the Muscoy plume since both the Newmark and Muscoy plumes may be emanating from the same source(s).

During the RI of the Muscoy OU, it became apparent that sufficient information was available to characterize the leading edge of the plume and develop alternatives to inhibit plume migration. Identification and characterization of the contaminant source(s) was expected to require more effort and a longer schedule. In January 1994, the Muscoy OU was divided into the Muscoy Plume OU for accelerated interim action and the concurrent Source OU for investigation and remediation of the source area. The Source OU, as the final RI, will also assess the combined cleanup efforts of the Newmark OU and the Muscoy Plume OU to determine whether additional groundwater cleanup actions are warranted.

The principal contaminants identified in all investigations since 1980 and the chemicals of concern (COCs) for this report are TCE and PCE (see Section 6.1 for more detail). These contaminants exceed Federal and California MCLs for drinking water in several municipal supply wells.

The RI/FS activities documented in this report were focused on the groundwater contamination in the Muscoy plume. As data were developed during the course of both this RI (Muscoy Plume OU) and the Newmark OU RI, it was determined that no residual soil contamination in the Muscoy plume area existed and that groundwater coming from upgradient was contaminated with TCE and PCE. The relatively low contaminant concentration and the pattern of groundwater contaminants indicate that the source is far upgradient (several miles) of the leading edge of the plume. This evidence is analogous with that in the Newmark OU, and further search for residual soil contamination in the vicinity of the Muscoy plume was not justified.

All sample data were collected from the existing municipal supply wells in the Muscoy plume OU investigation area. Results of the RI sample efforts were initially documented in the Interim Sampling Report for the Muscoy OU (URS, 1993b). The water quality data in this RI/FS report are drawn primarily from the Interim Sampling Report since these data were collected under the most controlled conditions. No monitoring wells were constructed and no other sampling efforts were conducted as part of the Muscoy Plume OU RI.

Only TCE and PCE were detected in Muscoy Plume OU groundwater at concentrations exceeding MCLs. However, one groundwater sample from one well contained cis-1,2-dichloroethene (DCE) at the State MCL of 6 $\mu g/\ell$. Freon 11 and freon 12 were also detected in the Muscoy Plume OU groundwater but at concentrations below their MCLs (freon 11 MCL: 150 $\mu g/\ell$; freon 12 MCL: none) and are, therefore, considered non-toxic concentrations.

1.1 PURPOSE

Under the authority granted under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA), EPA conducted a focused RI/FS of the Muscoy Plume OU. As stated in the National Oil and Hazardous Substances Contingency Plan (NCP), the purpose of an RI/FS is to assess site conditions and evaluate alternatives to the extent necessary to select a remedy.

The Muscoy Plume OU RI/FS was prepared and focused to address site-specific objectives and collect only those data necessary to develop and evaluate alternatives in support of a remedial design (RD). This report identifies the known groundwater contamination in municipal supply wells of the Muscoy Plume OU and provides long-term solutions through the selection of feasible remedial alternatives. Activities associated with this focus were designed to fulfill the following RI/FS and overall project (RI/FS and RD/RA) objectives:

RI/FS Objective:

1. Provide data for the Record of Decision (ROD) to support selection of the RD and construction of the selected remedy.

Overall Project Objectives:

1. Control contaminant plume migration.

   - It is apparent that contamination has migrated along the western side of Shandin Hills more than three miles downgradient from the suspected source(s) (Figure 1-1). Methods to prevent the leading edge of the plume from migrating further were investigated to support the selection and implementation of the most feasible alternative. The focus of the RI/FS was on a system of extraction wells with treatment facilities to arrest the spread of unacceptable levels of contaminants;

2. Protect downgradient municipal supply wells southwest of Shandin Hills in San Bernardino, California.

   - The alternatives that survived the evaluation in the Muscoy Plume OU FS were protective of human health and the environment through isolation and removal of unacceptable risks. Restoration of an aquifer to acceptable drinking water standards generally requires many years of treatment as well as isolation from the source or sources of contamination.

3. Facilitate the long-term cleanup objective of restoration of the aquifer to beneficial uses by removing groundwater contaminants.

   - The Muscoy Plume OU RI/FS addressed remedies that would assure effectiveness and completeness for consistency with this long-term cleanup objective. It should be noted that the Interim Action associated with the Muscoy Plume OU does not directly address the long-term cleanup objective but must be consistent with it.

The Muscoy Plume OU RI/FS was completed in three phases, with each phase providing information to guide the subsequent phase. The three phases were:

- Scoping Phase -- data gathering and preliminary modeling to identify essential data needs.
- Remedial Investigation Phase -- collection of necessary data and modification of preliminary analyses.
- Feasibility Study Phase -- development, screening, and detailed analysis of remedial alternatives

1.2 BACKGROUND

1.2.1 History of Regulatory Actions and Investigations

Groundwater contamination in the northern San Bernardino/Muscoy region was first detected in 1980 by the Department of Health Services - Office of Drinking Water (DHS-ODW)[1]. Eight City of San Bernardino municipal supply wells were found to contain levels of TCE and PCE above State Drinking Water Action Levels (currently 5.0 $\mu g/\ell$ for each). Four of these wells were located in the Newmark Wellfield at Reservoir Drive and Magnolia Avenue and the other four were in the Waterman Wellfield in the vicinity of 31st Street and Waterman Avenue. Following contaminant detection, pumping of these wells was discontinued, resulting in a loss of approximately 25% (28 million gallons per day [mgd]) of the City of San Bernardino's municipal water supply.

A more extensive groundwater sampling program was initiated by the Regional Water Quality Control Board (RWQCB), Santa Ana Region, and the DHS-ODW to closely monitor groundwater quality in the San Bernardino area. This program discovered TCE and PCE in eight additional wells in concentrations high enough to necessitate shutdown. The pattern of well contamination suggested relatively rapid southward (downgradient) migration of TCE and PCE, that, if unhalted, would pose a significant threat to downgradient municipal supply wells.

In September 1985, the RWQCB, Santa Ana Region, authorized a contract between the RWQCB and URS to study the local hydrogeology and ascertain potential contaminant sources. This report, completed in August 1986, identified 50 possible sources of groundwater contamination, including the now abandoned San Bernardino Airport (URS 1986).

In November 1986, the California Environmental Protection Agency - Department of Toxic Substances Control (DTSC)[2] signed a Determination of Imminent and Substantial Endangerment for the northern San Bernardino/Muscoy region, based on the closure of the municipal supply wells and the potential threat to downgradient wells. This action released state superfund money for interim remedial action (RA) in the Newmark Wellfield project and allowed DTSC and the City of San Bernardino to construct four air stripper towers; two - operational in 1988 - at the Newmark Wellfield Field; and two - operational since July 1989 - at the Waterman Avenue site.

Following implementation of this interim RA, several additional studies were undertaken in the northern San Bernardino/Muscoy area:

- In 1987, the County of San Bernardino completed a study of small quantity hazardous waste users in San Bernardino (including TCE and PCE users) in order to quantify and regulate the amounts of these contaminants used in the area.

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1 This office was formerly called the Department of Health Services - Public Water Supply Branch (DHS-PWSB).

2 California Environmental Protection Agency - Department of Toxic Substances Control (DTSC) was formerly called Department of Health Services - Toxic Substances Control Division (DHS-TSCD).

- During 1988, nine monitoring wells were drilled at three separate locations by the zone contractor for DTSC, Ecology and Environment, Inc. (E&E). E&E completed its preliminary assessment of the site in 1989.

In March 1989, the Newmark Wellfield was placed on the NPL. The EPA conducted a search to identify potentially responsible parties (PRPs) that contributed to the Newmark Wellfield contamination. In 1990, the EPA's Environmental Monitoring Systems Laboratory (EMSL) performed a review of aerial photography of the Newmark Wellfield to locate evidence of potential contamination sources.

In March 1993 the EPA published an RI/FS Report for the Newmark OU and the associated ROD was signed in August 1993. The interim RA identified in this ROD involved groundwater extraction and treatment at wells located at the leading edge of the Newmark plume. The remediation systems include extraction and treatment of 11.5 mgd in the vicinity of 14th Street, between Arrowhead and Waterman Avenues and an additional 5.8 mgd at the Newmark Wellfield. The RD phase of the Newmark OU was initiated in 1993.

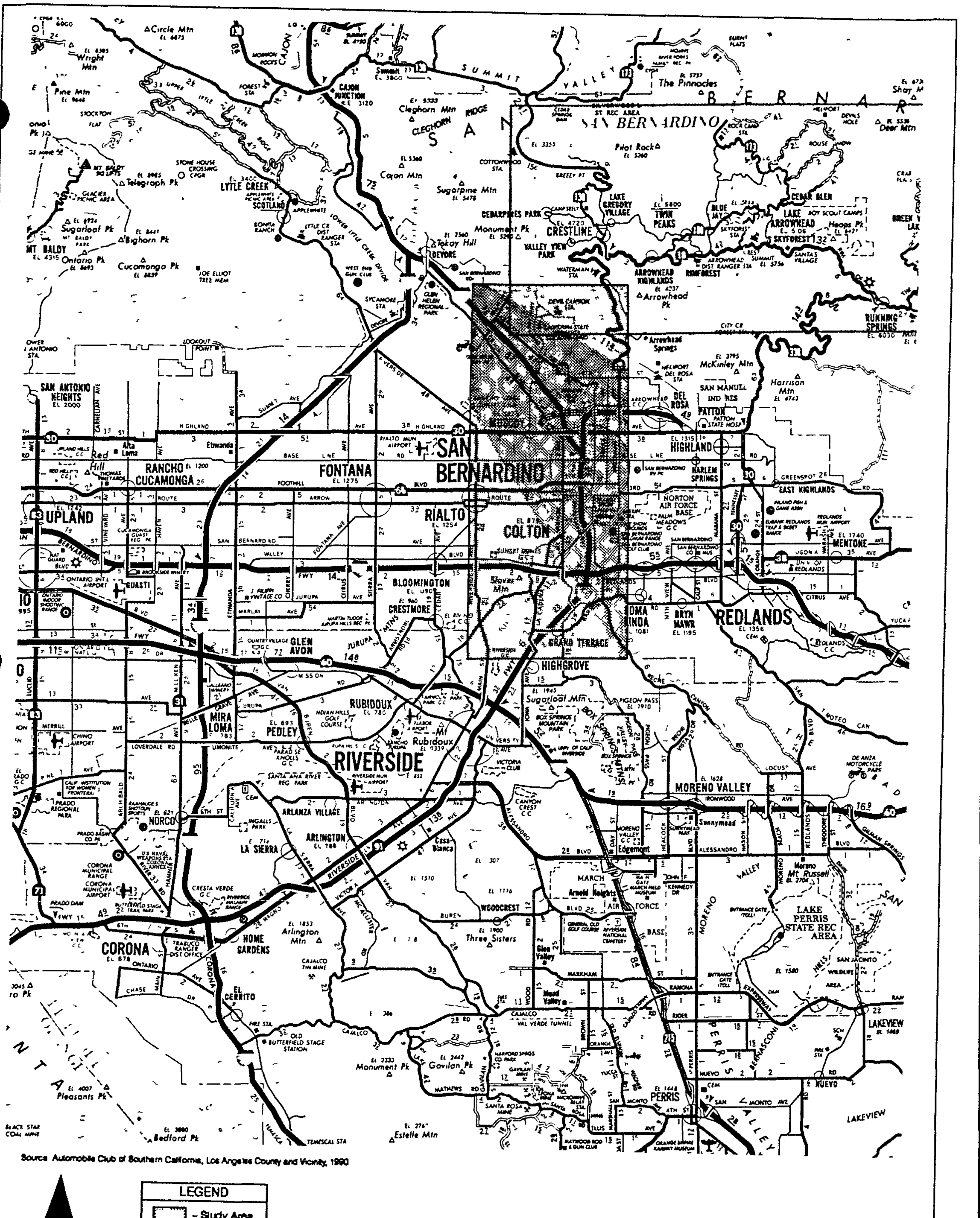
Subsequent to the signing of the Newmark ROD, the EPA divided the Newmark study area into the Newmark and Muscoy OUs (September 1993). In November 1993, the results of the interim sampling phase were presented in the previously mentioned ISR for the Muscoy OU. This sampling effort was conducted to verify and supplement data previously collected from both the Muscoy and Newmark OUs and also to help identify and characterized groundwater sources in these OUs. Based on the results of the ISR, the Muscoy OU was further subdivided in January 1994 into the Source and Muscoy Plume OUs. As previously discussed, these new OUs were created to expedite the interim actions necessary to control the Muscoy plume and allow the source investigation to proceed on a separate schedule. The RI/FS phase of the Source OU is ongoing.

1.2.2 Description of RI/FS Project Areas

To facilitate RI/FS activities, the region was divided into three distinct areas:

Study Area - This area pertains to the overall Newmark Groundwater Contamination Superfund Site. It covers approximately 80 square miles extending from the San Bernardino Mountains on the north to just south of Interstate 10 on the south. The western and eastern boundaries coincide with the borders of the San Bernardino North and South 7 1/2-minute quadrangles (Figure 1-2). The study area encompasses the Newmark, Source, and Muscoy Plume OUs and, therefore, all other areas described later in this subsection. The study area boundaries were established to allow the collection of all data pertinent to the site-wide groundwater flow modeling effort. Detailed descriptions of the study area data collected and model activities (see below) are presented in the Newmark OU RI/FS Report, Appendix J Newmark Project Flow Model Technical Memorandum, Parts I and II (URS 1993c).

Model Area - The model area is a subset of the study area and encompasses both the Muscoy Plume and the Newmark OUs. It is isolated on the north by the San Andreas Fault and on the southwest by the San Jacinto Fault. The western and eastern boundaries are equivalent to their study area counterparts (Figure 1-2). All groundwater flow modeling was performed for the entire model area.



Source: Automobile Club of Southern California, Los Angeles County and Vicinity, 1990

URS Consultants, Inc. Sacramento, Ca	MUSCOY PLUME OU RI/FS REPORT NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE	FIGURE 1-2 STUDY AND MODEL AREAS

Muscoy Plume OU Investigation Area - The area investigated encompasses the groundwater contamination in the Muscoy Plume as shown on Figure 1-1. Generally, this area includes the downgradient portion of groundwater contamination west of the Shandin Hills. It also includes all known municipal supply wells in Muscoy, including those with no contamination.

1.3 REPORT ORGANIZATION

This report has been organized in accordance with the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA Interim Final, October 1988).

1.0 Introduction

Introduction to the site and historic investigations.

2.0 Regional Setting

General description of physical and environmental conditions for study area; includes surface/subsurface features (geology/hydrogeology), climate, and demography.

3.0 Investigation Technique

Documentation of investigative field activities and field methodologies for sampling monitoring wells; includes analytical methods of data collection.

4.0 Investigation Area Characteristics

Focused description of physical characteristics (geology/hydrogeology) for the Muscoy Plume OU.

5.0 Nature and Extent of Contamination

Interpretation of data collected from groundwater samples of municipal supply wells; includes data for the Muscoy Plume OU only.

6.0 Contaminant Fate and Transport

Information on physical, chemical, and biological factors affecting contaminants; development of potential routes of contaminant persistence; evaluation of contaminant movement in groundwater through modeling; and a risk assessment.

7.0 Summary and Conclusions

Conclusions drawn from analytical data gathered from investigation activities, modeling, and other documents; summary of recommended RA objectives specifying contaminants of concern, exposure routes, and acceptable MCLs.

8.0 Remedial Action Objectives

Detailed descriptions of RA objectives/target cleanup levels to provide a design basis for screening technologies. Applicable or Relevant and Appropriate Requirements (ARARs) and a summary of the baseline health risk assessment are provided. The ARARs were furnished by the EPA.

9.0 General Response Actions

Description of actions that fulfill remedial action objectives are grouped into four categories: No Action, Institutional Actions, Collection/Treatment/Disposal Actions, Containment Actions.

10.0 Identification and Initial Screening of Technologies and Process Options

Presentation of technologies and process options that potentially meet general response actions; evaluation and initial screening of options for further consideration.

11.0 Evaluation of Technologies and Process Options

Summary of final screening evaluation of technologies and process options based on effectiveness, implementability, and relative cost.

12.0 Development and Screening of Alternatives

Definition of RA alternatives; screening evaluation for effectiveness, implementability, and relative cost.

13.0 Detailed Analysis of Alternatives

Detailed analysis of alternatives remaining after screening, according to the nine EPA criteria that address effectiveness, implementability, and relative cost; comparison of alternatives with respect to each criterion.